PRESIDENCY UNIVERSITY
BENGALURU

SCHOOL OF ENGINEERING

MAKEUP EXAMINATION – JAN 2023

Course Code: ECE 2007

Course Name: Digital Design

Programme   : B. Tech

Date: 23-JAN-2023

Time: 1:00PM to 4:00 PM

Max Marks: 100

Weightage: 50%

Instructions:
(i)   *Read Questions carefully and answer accordingly*
(ii)   *Scientific and Non- programmable calculators are permitted*
(iii)   *This Examination mode is OFFLINE*

PART A (Memory Recall Questions)
Answer all the questions. Each question carries TWO Marks.   **[15Q x 2M = 30M]**

1. NAND & NOR GATES are called as _____   **(CO.1) [B. Level: Knowledge]**
2. There are 16 input combinations in a digital system, how many minimum variables are required to frame a Boolean Function ?   **(CO.1) [B. Level: Knowledge]**
3. Karnaugh map is used to simplify Boolean expression. How many cells are present in 4 variable k-map. Each product term of a group, w'.x.y'z and wx.y,z represents the _____ in that group   **(CO.1) [B. Level: Knowledge]**
4. In two input NAND gate one of the input goes to low level, then the output is_____   **(CO.1) [B. Level: Knowledge]**
5   An Encoder is a combinational logic circuit; it encodes certain set of inputs to outputs. In 2^N: N

    encoder the OUTPUT has ____bit binary form.   **(C.O.No.3) [Knowledge]**

6   An adder is a combinational logic circuit whose output are sum and carry. If two numbers, $(6)_{10}$ and $(7)_{10}$ are added using a full adder. At LSB position of both the numbers, _____ will be the sum ---- and _____ will be the carry.   **(C.O.No.2)[Knowledge]**
7   A Half adder is an arithmetic circuit that adds two binary digits. It uses _____gate &_____gate.Its output are SUM & CARRY   **(C.O.No.2) [Knowledge]**
8   Multiplexer (MUX) is a Combinational logic circuit having single output line and many input lines. Four variable Boolean function can be implemented using (with the minimal select lines) ….....MUX.   .   **(C.O.No.3) [Knowledge]**
9   The outputs of a comparator irrespective of number of bits are _____, _____ and _____.
10 Any number can be represented in various base systems. Find the equivalent of $(12)_{10}$ in $(\_\_\_)_2$, $(\_\_\_)_8$, $(\_\_\_)_{10}$ and $(\_\_\_)_{16}$?   **(CO.1) [B. Level: Knowledge]**

11 A J-K flip flop is designed to overcome the shortcomings of S-R latch. What is the major difference between S-R latch and S-R Flipflop? How S-R Flipflop can be modified to work as a D-Flipflop.   **(C.O.No.3) [Knowledge]**

12 Multiplexer are combinational circuit which has certain input and output lines. In addition to this, other input signals are present in MUX design called select lines. A 16:1 MUX has_____inputs, _____output& _____selection lines . **(C.O.No.2) [Knowledge]**

13 For designing a 4 bit Asynchronous counter how many JK flipflop are required? Which input combinations it produces no change state? **(C.O.No.3) [Knowledge]**

14 T –flip flop is modified version of ------------------------Flip flop , In T-flip flop ,for what input combinations it produces no change state? **(C.O.No.3) [Knowledge]**

15 Digital circuits can be broadly classified as Combinational circuits, and Sequential circuits. In a combinational circuit, the output depends on ………. **(C.O.No.3) [Knowledge]**

PART B (Thought Provoking Questions)
Answer any 4 Questions. Each Question carries 10 Marks. [4Q x 10M = 40M]

16 .Roy and his friends are interested to design a block that has 16 input lines and 1 output and that block is named as Multiplexer that performs reverse operation of a De-Multiplexer. Help them to build the block but they have only 2:1 MUX. Hence, implement 16:1 MUX using 2:1 MUX.
[CO2 B. Level: Comprehension]

17.Mr JOY wants to implement a warning buzzer when the following conditions apply:
- Switches A, B, C are on.
- Switches A and B are on but switch C is off
- Switches A and C are on but switch B is off.
- Switches C and B are on but switch A is off.

Draw a truth table for this situation and obtain a Boolean expression for it.Minimize this expression and draw a logic diagram using NAND GATES.
[CO2 B. Level: Comprehension]

18. Find the Boolean expression in sum of product (SOP) from the given truth table and simplify the expression using K Map.

Inputs			Outputs
A	B	C	F
0	0	0	1
0	0	1	1
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	0
1	1	0	0
1	1	1	1

[CO2 B. Level: Comprehension]

a)Design and implement the simplified logic using LOGICAL GATES.

b) Design and implement the simplified logic using 4:1 MUX **[CO2 B. Level: Comprehension]**

19. A comparator is a device that compares two bits, voltage or currents and outputs a digital signal indicating which is larger. Design a **1-Bit comparator** with the help of truth table and obtain the logical expression for each case with the help of simplification method (K-map).

[CO2 B. Level: Comprehension]

PART C (Problem Solving Questions)
Answer any 2 the Questions. Each Question carries 15 Marks.   [2Q x 15M = 30M]

20. You can create a *3*-input, *3*-output circuit that maps one state in the *count* sequence to the next. Design synchronous 3 bit up counter using T flipflop.
      a. Write excitation table of Flip Flop
      b. Draw the state transition diagram and circuit state table.
      c. Find a simplified equation using k map.
       d. Create a circuit diagram   **(C.O.No. 3) [Application]**

21. In Boolean algebra, circuit minimization is the problem of obtaining the smallest logic circuit that represents a given Boolean function or truth table. Mr Joel is provided with Boolean function $F=\sum m(0,1,4,7,9,13,15)$

    a) Write whether the below expression is an SOP or POS expression and what is the full-form? Write whether the below expression is a min-term or max-term expression? How many variable K-map we need to simplify the below expression? Draw the K-map and simplify the above expression by showing all the steps.

    b) Implement the simplified expression obtained in Part (b) using basic gates.

    c) Implement the simplified expression obtained in Part (b) using NAND gates. .

(C.O.No. 2) [Application]

22. A sequential circuit refers to a special type of circuit where the outputs depend on a combination of both the present inputs as well as the previous outputs.

    a) Discuss the comparison between Synchronous and Asynchronous circuits.
    b)Design a 3-bit Asynchronous up-counter, how many flip flops required and mention the number of states using state diagram.   **(C.O.No. 2) [Application]**

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